Text accompaniment for Wisconsin DNR Wellhead Protection Slideshow

Slide 1. An Ounce of Prevention
We all depend on having a safe supply of drinking water every time we turn on the tap. But what if your community's water supply were contaminated? It would no doubt be expensive and time-consuming to clean up groundwater and provide another source of water to the citizens of your community. Wellhead protection (WHP) is an ounce of prevention; it is a method for protecting water supplies at a fraction of the cost of cleanup. WHP is an increasingly important component in a plan to deliver good quality water. The key word is protection of existing and new water supply sources. Many Wisconsin communities have spent millions of dollars to correct water quality problems after their wells went online. With WHP planning, some of this money could likely have been saved.

Slide 2. What is Wellhead Protection?
Wellhead protection is a program designed to minimize the risk of contamination to public groundwater supplies. This can be accomplished by managing the land area around a well. The water that recharges your community's well or wells likely came from rain or snow which fell near the well and seeped into the ground. Management of the land and activities around a well is crucial to developing a successful WHP plan. Knowing what land use practices are taking place, what activities are being conducted, what materials are being used and stored in the WHP area are key. By taking steps to manage the land area around a well, the potential for contamination is minimized.

Slide 3. Benefits of Wellhead Protection
There are a number of benefits to a community in developing and implementing a wellhead protection plan. One important benefit is to save money by avoiding costs for cleaning up groundwater and/or providing an alternate water supply. In the last fifteen years, Wisconsin communities have spent over $10 million dealing with nitrate contamination and over $16 million to address contamination from organic chemicals like gasoline and pesticides. A second benefit is to avoid the health risks to the citizens of the community that would occur if they drank contaminated groundwater. Another benefit is to prevent the negative economic impact of contaminated drinking water on community development. A business isn't going to move into a community if they don't have a good water supply. Wellhead protection planning also serves to protect the water supply for the future, for those who will follow in our footsteps.
The wellhead protection planning process has some other useful benefits to the community as well. It provides an opportunity to educate the community on the importance of protecting its water supply, it provides an opportunity to learn what the threats to the water supply are and develop a plan to address those specific threats, it can promote public involvement in keeping its water safe, it provides an opportunity for a community to develop a contingency plan for well contamination, and it can promote interjurisdictional cooperation to protect the groundwater resource.

Slide 4. Regulations
Wisconsin's WHP program includes both a regulatory and voluntary component. The regulatory component covers wells constructed May 1, 1992 or after. Communities constructing a new well must develop a WHP plan and submit it to the Department for approval. The well can't be used until the plan is approved by the Department. Wellhead protection is voluntary for existing municipal wells constructed before May 1, 1992. The Department encourages communities to be proactive in protecting its existing wells through WHP planning, but can not require a community to do so.

Slide 5. Components of Wellhead Protection
The following five components are the basic outline for developing a WHP plan. The first step is to establish a local planning team. This consists of getting together a group of community officials, business and private citizens who will oversee the process and make sure the plan is developed and implemented. This group could include representatives of the water utility; local health, fire, planning and zoning officials; farmers or business representatives; service organization representatives; elected officials; and interested citizens.
Component 2 is to define the WHP area around the well. The WHP area is the land area that contributes water to the well. The wellhead protection area is the land area that contributes water to the well. This is an important determination because it identifies the area to be protected. An accurate delineation requires an

understanding of the groundwater conditions in the vicinity of the well. A variety of methods can be used and are discussed later. It is important to realize that the WHP area is not always static and can change with changes in land use and pumping.
Component 3 is to identifying potential contamination sources within the WHP area. A variety of land uses, including landfills, service stations, agriculture, chemical handling and storage, spills, and others can create a threat to a water supply well. These potential sources need to be located. The Department publication, "A Guide for Conducting Potential Contaminant Source Inventories for Wellhead Protection" contains step by step procedures for locating these sources and an extensive list of land uses to look for.
The fourth component is to use the information on potential contaminant sources to develop and implement a management plan to protect the water supply. A number of regulatory and non-regulatory options are available to meet the particular needs of a community. These include, but are not limited to, conducting routine groundwater monitoring, conducting a public education campaign, working with potential sources of contamination to ensure proper handling and disposal methods, land purchases, zoning and subdivision regulation, or a private well abandonment ordinance. More options are discussed later.
The last component is to development a contingency plan in the event contamination occurs. The water utility needs to be prepared to respond quickly to provide water to its customers and also deal with the groundwater contamination. Contingency planing is discussed later.

Slide 6. Wellhead Protection Steps
Wisconsin Administrative Code NR 811 requires that a community planning a new well must complete a wellhead protection plan for that well. NR 811 specifies what information must be included in that plan. The nine required components or elements are described in the slides that follow. More information on these elements is contained in a new Department document, "A Template for Preparing Wellhead Protection Plans for Municipal Wells." The first step is to determine the direction of groundwater flow.

Slide 7. Determining Groundwater Flow Direction
Determining groundwater flow direction is critically important in wellhead protection. Knowing the flow direction, you can focus protection efforts upgradient of the well location because that's where the groundwater is coming from. Generally, groundwater follows topography, moving from higher to lower elevations. You don't need to focus much effort in the down gradient flow direction because that water is not being captured. Groundwater flow direction can be determined by plotting water level elevations on a map and contouring between data points. Flow direction can then be determined by drawing perpendicular (90 degrees) lines across the contour line.

Slide 8. Determining the Water Table
Determining the table can be done using maps are already available for many counties and specific projects from the Wisconsin Geological and Natural History Survey (WGNHS) or the United States Geological Survey (USGS). If you want to create one for your local area, well construction reports are available from the WGNHS (contact Irene Lippelt at 608-262-7430), the Wisconsin Department of Natural Resources (contact Judy Gifford at 608-266-0153) or the Department website (www.dnr.state.wi.us/org/water/dwg/dws.htm). Water table maps can be prepared for specific sites using existing data or by installing monitoring wells to determine water level elevations.

Slide 9. Wellhead Protection Steps
The next step is to determine the zone of influence for the well.

Slide 10. Zone of Influence
The zone of influence (ZOI) for a well is defined as the land surface area beneth which the water table would decline due to pumping of the well. This is commonly known as the cone of depression, an area at the surface that would be encompassed by the pumping of the well. The ZOI can be calculated by a number of computer programs or the Theis methods and normally involves conducting a pumping test of the well.
The zone of contribution (ZOC) is the land area that contributes water to the well. This area will be somewhat different than the ZOI for a well. The ZOI would be more elongated in the upgradient direction of groundwater flow, extending to the groundwater divide. This is also called the recharge area. Note that the ZOI extends farther downgradient than the ZOC. This means that, although groundwater levels will decline downgradient due to pumping, not all of that groundwater will be pulled into the well.

Slide 11. Wellhead Protection Steps
The next step is to determine the recharge area for the well

Slide 12. Recharge Area
The recharge area can be described as the total area contributing water to a well back to the groundwater divide. The recharge area can be calculated using a number of techniques. The Uniform Flow Equation is one method defined below where:

$$XL = \text{downgradient null point} = \frac{Q}{2*3.14159Kbi}$$

$$YL = \text{side gradient width} = \frac{Q}{2Kbi}$$

Where:
XL = down gradient null point (ft)
YL = side gradient width (ft)
Q = pumping rate (gpm)
K = hydraulic conductivity (ft/day)
b = aquifer thickness (ft)
i = hydraulic gradient (ft/ft)
Kb = transmissivity (gpd/ft)
The recharge area can also be defined by flow system mapping or by more advanced groundwater modeling.

Slide 13. Wellhead Protection Steps
The next step is to define the wellhead protection area.

Slide 14. Wellhead Protection Area
A wellhead protection area can be calculated using a variety of methods. A simple method calculates a fixed radius around the well using the formula defined below:

$$r^2 = \frac{Qt}{3.14159 * nH}$$

where:
Q = volume pumped per day
t = time (5 years) or 1825 days
n = porosity of the aquifer
H = height of the open interval or screen (ft)
Using an arbitrary radius or a calculated fixed radius produces a circle (as shown in red on the graphics version slide). That's because neither method considers the groundwater flow direction. Other methods such as the WHPA codes developed by the USEPA or groundwater models typically produce an elongate shape extending upgradient. The black ellipse represents the wellhead protection area delineated using a WHPA code. For more information on delineation methods, see the Department publication, "Determining Wellhead Protection Area Boundaries - An Introduction."
The wellhead protection area for a new well must include the recharge area for a five-year time of travel with a minimum radius of 1200 feet around the well.

Slide 15. Wellhead Protection Steps cont.
Once the wellhead protection area has been delineated, the next step is to inventory potential contaminant sources.

Slide 16. Contamination Sources
Many land use activities have the potential to contaminate a water supply well. Some examples are shown in this slide and the next. An inventory of these potential contamination sources is required in a wellhead protection plan to assist in development of protection strategies for that well. A diligent inventory process will help determine what potential contaminant sources are within the wellhead protection area and should be should be focused on to prevent problems. A complete listing of all possible sources is too long a list for

this discussion, but a short example of what to look for is listed below. A document you can use to assist in the inventory process for public wells is the Public Water Supply Contaminant Use Inventory Form (DNR form # 3300-215).

POTENTIAL CONTAMINATION SOURCE	DISTANCE AND DIRECTION
Storm sewer	150 feet northeast of well
Sanitary sewer	500 feet west
Residential fuel oil tank	250 feet north
Septic tanks	475 feet northeast , 637 feet north, 1000 feet east
Drain field	500 feet northwest
Cemetery	1000 feet southeast
Storm water pond	500 feet southeast
Co-op	800 feet east
Commerce approved gasoline tank	600 feet north
Petroleum spill	2000 feet southeast
Wastewater lagoon	2000 feet northwest
Sanitary landfill	2500 feet north

Slide 17. Inventorying Contaminant Sources
A contaminant source inventory is an effort to locate and identify those facilities and activities within a designated area that may be a potential source of contamination to a public water supply well. For a new municipal well, the inventory must include the area within ½ mile of the well. In addition, the wellhead protection plan must include as assessment of potential sources within the entire recharge area of the well.

Slide 18. Wellhead Protection Steps cont.
The next step is to use the contaminant source inventory information to develop a management plan for the wellhead protection area.

Slide 19. Management Plan
For a new municipal well, the wellhead protection plan must include a management plan which assesses the alternatives for addressing potential contamination sources and describes the local ordinances, zoning requirements, monitoring program, and other local initiatives proposed to be enacted within the WHP area. The management plan shall have regulatory mechanisms to address maintaining the separation distances identified in NR 811.16(4). A community may want to consider even larger management zones to reduce the vulnerability or susceptibility of the well to contamination. Larger areas could be used to support monitoring waivers and reduced sampling requirements along with protecting the well.
Each community or water utility needs to decide, based on an evaluation of the potential contaminant sources, how best to protect their well or wells within the WHPA. A number of regulatory and nonregulatory options are available to a community. Options may include, but are not limited to the following short list of examples:

- Zoning Ordinances (municipal or county wide)
- Subdivision Regulations
- Land Use Planning
- Setback Distances
- Public Education Campaign
- Clean Sweep Program
- Groundwater Monitoring
- Well Abandonment
- Land Purchases
- Working with Owners of Potential Contamination Sources
- Working with Other Jurisdictions

Slide 20. Wellhead Protection Setback Distances
NR 811.16(4), Wisconsin Administrative Code, lists separation distances for potential contamination sources that must be maintained in siting a new well. These separation distances are listed in the following slides.

Slide 21. Wellhead Protection Setback Distances
The property must be 100 feet by 100 feet and the well must be 50 feet from a storm sewer main.

Slide 22. Wellhead Protection Setback Distances cont.
Well must be 200 feet from a sanitary sewer main, lift station, or single family residential fuel oil tank.

Slide 23. Wellhead Protection Setback Distances cont.
Well must be 400 feet from a septic tank receiving less than 8,000 gal/day, a cemetery or a storm water drainage pond.

Slide 24. Wellhead Protection Setback Distances cont.
A well must be 600 feet from any gasoline or fuel oil storage installation that has received written approval from the Department of Commerce or its designated agent.

Slide 25. Wellhead Protection Setback Distances cont.
A well must be 1000 feet from land application of municipal, commercial or industrial waste; industrial, commercial or municipal waste water lagoons or storage structures; manure stacks or storage structures; and septic tanks or soil adsorption units receiving 8,000 gallons per day or more.

Slide 26. Wellhead Protection Setback Distances cont.
A well must be 1200 feet from any solid waste storage, transportation, transfer, incineration, air curtain destructor, processing, wood burning, one time disposal or small demolition facility; sanitary landfill; coal storage area; salt or deicing material storage area; gasoline or fuel oil storage tanks that have not received written approval from the Department of Commerce or its designated agent under s. ILHR 10.10; bulk fuel storage facilities; and pesticide or fertilizer handling or storage facilities.

Slide 27. Wellhead Protection Steps cont.
The next step is to develop a public education strategy.

Slide 28. Public Education
Public education is an important step in getting the WHP plan to actually work in the community. It is critical to have everybody in the community understand what is happening, why it's important, what they can do to help and who it will effect. The methods for providing public education for the wellhead protection plan should be documented. Additional efforts can be focused on working directly with potential sources to educate owner/operators on the importance of proper material handling to the protection of groundwater.
There are many activities that can help promote WHP in a community. A short list could include; making the WHP plan available; make other related publications available; talking to schools and youth groups; providing focused education by targeting it based on the contaminant source inventory; work with the local media in the form of newspaper advertisements, radio and television spots; and using directed mailings to the citizens of the community.

Slide 29. Wellhead Protection Steps cont.
The next step is to develop a water conservation plan.

Slide 30. Water Conservation
A water utility should have a water conservation plan for reducing water demand. There are a number of options available. Some ideas include promoting water conservation through brochures, determining where water losses are occurring and correcting them, conducting a public education program, promoting the use of water saving fixtures, enacting a sprinkling ban or restriction, or changing the rate structure to encourage conservation.

Slide 31. Wellhead Protection Steps cont.
The last step is to develop a contingency plan.

Slide 32. Contingency Plan
A utility should have a plan for providing safe water in an emergency, if the well becomes contaminated or if a spill or major leak occurs at one of the inventoried potential contamination sources. The plan could include emergency connections to another water utility, trucked or bottled water, or reliance on other existing wells to meet the demands of the water system. The response plan should include the names and telephone numbers of people at the water utility, the Department of Natural Resources, the police and fire departments, and other people who may be involved in planning solutions to the emergency or with the cleanup of the spill. The contingency plan is closely tied to the conservation plan, capacity development and general land use planning.
In addition, the water system should have their engineer, consultant, or specialist prepare an assessment of the water system's capability to handle emergencies. Additionally, a longer term plan could be developed looking at future well siting locations, land use issues, future growth and storage needs.

Slide 33. Assistance Available to Communities
Wellhead protection assistance is available from a number of sources including the Wisconsin Department of Natural Resources, Wisconsin Rural Water Association, Central Wisconsin Groundwater Center, or from private consulting firms. Each of these is discussed in more detail in the remaining slides.

Slide 34. Wisconsin DNR Assistance
The DNR has produced a number of publications related to WHP including: "A Template for Preparing Wellhead Protection Plans for Municipal Wells"; "State of Wisconsin Wellhead Protection Program Plan for Public Water Supplies"; "Determining Wellhead Protection Area Boundaries - An Introduction"; "A Guide for Conduction Potential Contaminant Source Inventories for Wellhead Protection"; and a brochure titled "Wellhead Protection: An ounce of prevention..."
A video, produced by the DNR, is available titled "An Ounce of Prevention - Wellhead Protection." This 16-minute video was developed to encourage communities to be proactive in protecting their municipal water supply through wellhead protection planning. Preventing contamination makes more sense than having to deal with a contaminated water supply.
The video focuses on the steps needed to protect community wells and the benefits of preserving clean drinking water including: protecting citizen health, building community support, and enhancing economic growth. It shows how three Wisconsin communities formed committees of local citizens and technical experts who successfully used wellhead protection planning to safeguard their valuable water supplies. The video also identifies resources to help communities get started. This program is a joint effort between the DNR, several Wisconsin communities and partnering groundwater organizations.
Department staff are available to speak at public meetings, or provide help starting a wellhead protection plan for existing water supply wells drilled before May 1, 1992. Each of the 5 DNR regions has a staff member assigned to provide help and/or assistance. For further information call, e-mail or visit the web site.
Phone: 877-268-WELL (toll free) or 608-266-9265 (Madison, WI)
E-mail: Lindod@dnr.state.wi.us
Web Site: Http:\\www.dnr.state.wi.us/org/water/dwg/gw/whp.htm

Slide 35. Rural Water Assistance
The Wisconsin Rural Water Association can provide technical assistance to communities with public water supplies serving less than 10,000 people. For further information write, call, e-mail or visit the web site.
350 Water Way
Plover, WI 54467
Phone: (715) 344-7778
E-mail: wrwa@coredcs.com
Website: Http://www.wrwa.org

Slide 36. Central Wisconsin Groundwater Center Assistance
The Central Wisconsin Groundwater Center is a University of Wisconsin Extension Agency. They can help communities in central Wisconsin with questions and provide some technical assistance. For further information write, call, e-mail or visit the web site.
College of Natural Resources, room 224
University of Wisconsin - Stevens Point
Stevens Point, WI 54481
Phone: (715) 346-4270
E-mail: gndwater@uwsp.edu
Website: Http://www.uwsp.edu/groundwater

Slide 37. Consultant Assistance
All municipal water supplies are planned and constructed with the oversight of an engineering or consulting firm. For a fee, consultants will provide technical expertise, assistance, or complete development of a WHP plan for existing wells. A WHP plan is required for all new wells constructed after May 1, 1992. For assistance check Engineering Firms in the yellow pages.

Slide 38. Wellhead Protection - Conclusion
The purposes of this slide presentation are to demonstrate the importance of wellhead protection - an ounce of prevention, and describe the steps involved and indicate the resources available to assist communities with wellhead protection planning. A great deal of information is contained in this presentation. Feel free to make use of it by copying selected portions or printing out the entire presentation. This information can be a valuable resource when looking for ideas and assistance in developing a current or future wellhead protection plan.